

## SECTION 603 – SANITARY SEWER FORCE MAINS

### 1. GENERAL

PVC pipelines for sanitary sewer force main systems shall conform to the following specifications and shall be installed at the locations indicated on the drawings.

### 2. TRENCH AND BACKFILL

Trench excavation and backfill shall conform to the requirements of the Section 101, entitled "Trench and Backfill." Minimum depth of cover for PVC pipeline shall be four and one-half feet (4-1/2') below the finished grade.

### 3. POLYVINYL CHLORIDE PIPE

Polyvinyl chloride pipe shall conform to AWWA Specification C900, "Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch for water", unless otherwise designated on the plans or special provisions. The pipe shall be Class 200 (cast iron O.D.) suited for a working pressure of 200 p.s.i. at 73°F and shall be dimension requirements of DR14. Pipe shall be manufactured from clean, virgin, NSF approved Class 12454-A or 12454-B PVC conforming to requirements of ASTM D1784 (latest revision).

For pipeline larger than 12-inch, polyvinyl chloride pipe shall conform to AWWA Specification C905, "Polyvinyl Chloride (PVC) Pressure Pipe, 14-inch through 36-inch for water", unless otherwise designated on the plans or special provisions. The pipe shall be Class 235 (cast iron O.D.) suited for a working pressure of 235 p.s.i. at 73°F and shall be dimension requirements of DR18. Pipe shall be manufactured from clean, virgin, NSF approved Class 12454-A or 12454-B PVC conforming to requirements of ASTM D1784 (latest revision).

Provisions must be made for contraction and expansion at each joint with a rubber ring and integral thickened bell as part of each joint. Pipe shall be supplied in 20-foot lengths. A non-toxic lubricant shall be used to assemble all pipe and fittings.

Each length of pipe shall have marked on the exterior the appropriate manufacturer and pipe specification information. Prior to installation of any pipe on the project, the Contractor shall be required to furnish in writing the proper certification from the manufacturer or a recognized testing agency that the pipe fulfills every requirement of the specifications set forth above.

### 4. PIPE JOINTS

Polyvinyl chloride pipe joints shall conform to requirements of AWWA C900, Class 200 or AWWA C905, Class 235, respective to the pipe specified, cast-iron (CI) pipe dimensions only, elastomeric-gasket joint only.

### 5. PIPE FITTINGS

Cast iron pipe or ductile iron fittings shall conform to AWWA Specification C-110 or C-153 (compact fittings), and shall be Class 350 psi working pressures. All fittings shall have standard tar coating exterior and epoxy lined interior.

## 6. INSTALLATION OF POLYVINYL CHLORIDE PIPE AND FITTINGS

Polyvinyl chloride pipe, fittings and accessories shall be handled in such a manner as to insure delivery to the site of the work in sound, undamaged condition. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved methods.

Before installation, the pipe shall be inspected for defects. Any defective, damaged or unsound pipe shall be rejected. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place. The pipe shall be properly protected against the detrimental effects of heat, harmful chemicals and ultraviolet radiation. Special attention shall be given to the ends of each pipe section so that the outer roundness of the pipe remains virtually unchanged. Deformation of the pipe and fittings will make connections between sections of the pipe difficult or impossible and shall be reason for rejection. At the direction of the Engineer, the contractor shall at no cost to the owner conduct dimension tests of PVC pipe and fittings in accordance with ASTM D2122. Any pipe section or fitting not meeting the ASTM standards shall be rejected and replaced.

Cutting of pipe shall be done in a neat and workmanlike manner by a method, which will not damage the pipe. All PVC pipe and fittings shall be installed in accordance with the manufacturer's instruction and shall be laid in a flat bottom trench with proper bedding and compacted backfill. Pipe laying shall proceed upgrade with spigots pointing in the direction of flow. The trench shall consist of a minimum of four (4) inches of compacted select pipe bedding material below the pipe, select backfill material to a minimum of 12 inches above the crown of the pipe and standard backfill material from 12 inches above the pipe to the top of the trench in accordance with Section 2, entitled "Trench and Backfill." The select bedding material, when the trench is dry and stable and dewatering is not required, shall be a sand-gravel mix conforming to Kansas Department of Transportation Standard Specifications for BD-1 underdrain aggregate. Select backfill material shall also conform to KDOT BD-1 underdrain aggregate. Bedding and backfill material shall be compacted to a minimum of ninety (90) percent of standard Proctor density using hand or mechanical tamping. If the trenches are wet or unstable or dewatering is required, the appropriate bedding material shall be determined by the Engineer.

The trench subgrade shall be prepared to provide a uniform and continuous pipe support between pipe bells or joints. Place and consolidate select bedding material by shovel slicing, or vibrating, and prepare select bedding material so that the pipe will be true to line and grade after installation. After each pipe has been brought to grade, aligned and placed in final position, deposit and consolidate by shovel slicing sufficient select bedding material under the pipe haunches and on each side of the pipe to hold the pipe in proper position during subsequent pipe jointing, bedding and backfilling operations. Place select bedding material uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

## 7. FITTING BLOCKING

All tees and plugs, and all bends deflecting the alignment of six (6) inch and larger pipe lines by 22-1/2 degrees or more, shall be blocked against undisturbed earth to prevent the pressure and velocity from displacing the fitting. Blocking shall be constructed of

concrete poured against the undisturbed trench wall, forming a solid bearing area at least three (3) times the pipe diameter vertically, and at least four (4) times the pipe diameter horizontally; all dimensions to be symmetrical from the center of the fitting, and the bearing place normal to the direction of the displacing pressure. Minimum thickness of the blocking shall be four (4) pipe diameters.

#### 8. TESTING

All joints in pressure pipelines shall remain exposed until the pipe has been pressure tested at 50 pounds in excess of the computed static pressure at the point of reading. When all joints being subjected to test are found tight at this excess pressure, in the presence of the Engineer, the test may be stopped and backfilling commenced. The cost of testing the pipelines shall be borne by the Contractor, who shall furnish all equipment necessary for the tests.

A. Leakage. Leakage is defined as that amount of water necessary to be added to the pipeline to maintain the specified leakage test pressure during the entire 60-minute testing period.

B. Permissible Leakage. No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{ND (\sqrt{P})}{7,400}$$

in which L equals the allowable leakage, in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall at his own expense locate and repair the defective joints until the leakage is within the specified allowance.

Duration of simultaneous and separate pressure and leak tests is 2 hours, 1 hour and 2 hours, respectively. The pressure in the water line during the pressure or leakage test is not to vary more than 5 psi from the designated test pressure.

#### 9. SEPARATION OF WATER MAINS AND POLLUTION SOURCES

It is of utmost importance that potable water lines be protected from any source of pollution. The following shall pertain to instances where individual or industrial septic tanks and tile absorption fields, waste stabilization ponds, waste water lines discharging into roadside ditches, feedlots, or other sources of pollution are encountered.

A. A minimum distance of 25 feet shall be maintained between all potable water lines and all septic tanks, waste stabilization ponds or open sewage discharge locations.

B. Under no circumstances shall a water line extend through a septic tank tile absorption field, or feedlot. All water lines shall be located a minimum of 25 feet from the farthest known extent of any sewage absorption.

C. A minimum horizontal distance of 10 feet shall be maintained between parallel water and sewer lines. The laying of potable water lines and sanitary sewers shall be in separate trenches with undisturbed earth between them. In cases where it is not practical to maintain a 10-foot separation, the City Engineer may consider proposals providing equivalent protection by other methods on a case-by-case basis, if supported by data from the design engineer. Equivalent protection may require sanitary sewer construction with one of the following additional protective features: concrete encasement, vacuum sewers, or jointless pipe such as polyethylene or cured-in-place.

D. When a water pipe and a sanitary sewer cross and the sewer is 2 feet or more (clear space) below the water pipe, no special requirements or limitations are provided herein. At all other crossings, the sanitary sewer is to be constructed of one of the following materials (or approved equal) and pressure tested to assure water tightness pursuant to Chapter VI of the KDHE Minimum Standards of Design of Water Pollution Control Facilities:

PVC pipe conforming to ASTM D3034 with minimum wall thickness of SDR26, ASTM F679, ASTM F789, or ASTM F794, with gasketed push-on joints in conformance with ASTM D3212.

Joints in the sewer pipe shall be located as far as practical from the intersected water main.

E. Where a water main is laid across or through an area where there is an existing sanitary sewer, which is not constructed of one of the above specified materials and is 2 feet or less below the water pipe, the existing sewer shall be encased in concrete with a minimum of 6 inch thickness for a 10 foot distance on each side of the crossing or the crossed section of sewer requirements. The City Engineer may consider proposals providing equivalent protection by other means on a case-by-case basis, if supported by data from the design engineer.

F. Under no condition will it be considered that encasement of the water main through an area of real or potential pollution would provide the protection needed to the water supply.

#### 10. MARKING TAPE AND TRACER WIRE

Marking tape and tracer wire shall be provided whenever PVC pipe is installed. The tape shall be of plastic material without integral wires or foil backing. The tape shall be not less than 2 inches wide, and shall have an identifying phrase in black letters repeated at maximum intervals of 3 feet. The tape shall be of a type specifically manufactured for marking underground utilities. The tape shall be installed during backfilling operations. Tape shall be located 2 feet below finished grade. The tape shall be centered on the utility line with the identifying phrase on the top. The identifying phrase shall be SEWER LINE BELOW.

Tracer wire shall not be integral to the marking tape. The wire shall be 16 gauge copper encased in a protective plastic jacket or provided with other means to protect it from corrosion. The wire shall be placed above the water pipeline, taped to the pipeline at 25-foot intervals. The wire shall be terminated at each valve box by providing adequate slack wire inside the valve box for use by detection equipment.